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Personalized pricing decisions through adversarial risk analysis

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Abstract-

Pricing decisions stand out as one of the most critical tasks a company faces, particularly in today's digital economy. As with other business decision-making problems, pricing unfolds in a highly competitive and uncertain environment. Traditional analyses in this area have heavily relied on game theory and its variants. However, an important drawback of these approaches is their reliance on common knowledge assumptions, which are hardly tenable in competitive business domains. This paper introduces an innovative personalized pricing framework designed to assist decision-makers in undertaking pricing decisions amidst competition, considering both buyer's and competitors' preferences. Our approach (i) establishes a coherent framework for modeling competition mitigating common knowledge assumptions; (ii) proposes a principled method to forecast competitors' pricing and customers' purchasing decisions, acknowledging major business uncertainties; and (iii) encourages structured thinking about the competitors' problems, thus enriching the solution process. To illustrate these properties, in addition to a general pricing template, we outline two specifications—one from the retail domain and a more intricate one from the pension fund domain.

Index Terms- pricing decisions; business competition; decision analysis; adversarial risk analysis; Bayesian methods

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